EPICONTINENTAL SEAS VERSUS OPEN-OCEAN SETTINGS: EXTINCTION AND DIVERSIFICATION IN TWO DIFFERENT WORLDS?

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Among the major transitions observed in the history of Phanerozoic marine biodiversity is the loss of biotas associated with epicontinental seas, broad areas of shallow water that covered large proportions of several paleocontinents during the Paleozoic Era. In particular, the Mesozoic and Cenozoic Eras were characterized by a significant decline in the areal coverage of shallow carbonate platforms, such that the majority of carbonate sedimentation in the post-Paleozoic has been relegated to deeper, oceanic settings. Despite this profound secular change in the nature of marine habitats, relatively little is known about its effects on transitions in the evolutionary dynamics of the global marine biota. Phanerozoic-scale, secular declines have been observed in background global rates of marine diversification and extinction, but the possible linkage of this decline to the loss of epicontinental seas has not been evaluated. As part of my ongoing Exobiology-funded research, I investigated the recoveries of marine biotas from major Phanerozoic mass extinctions, and have discovered that recovery biotas (the taxa that originate in the aftermaths of mass extinction) tend to consist of taxa that are significantly longer lived, from an evolutionary perspective, than those originating at other times. Importantly, this pattern is only evident among recovery biotas of the post-Paleozoic, beginning with the Triassic recovery from the end-Permian mass extinction. During the Paleozoic, there is no indication of these longevity spikes, but, thereafter, the pattern is a common feature of the evolutionary record. This, in turn, suggests either that the nature of mass extinction-inducing physical catastrophes changed after the Paleozoic, or, more likely, that the way in which biotas responded to these catastrophes underwent a profound transition. The latter possibility has motivated me to begin investigating whether the transition relates directly to the decline of epicontinental seas and their associated biotas and, more broadly, whether the nature of evolutionary turnover was profoundly different in the two settings. To this end, I am currently investigating the evolutionary dynamics of biotas from the Jurassic Period in a paleogeographic context. Because epicontinental seas were still reasonably extensive in the Jurassic at the same time that the areal coverage of open ocean biotas had apparently grown beyond Paleozoic levels, this interval provides a window in which to compare coeval biotas from both settings. At the Exobiology symposium, I will present the preliminary results of these comparisons, using data contained in the Paleobiology Database (http://paleodb.org).